Invention

Image Pickup Apparatus Including a Solid-state Imager Having a Plurality of Light Receptive Areas

US patent 7248295 (JP 2004-032212)

This invention relates generally to image pickup apparatuses and more particularly to an image pickup apparatus using a solid-state image pickup device (or imager), in which a light-receptive region is divided into a plurality of areas so that an image signal is output from each of the light-receptive areas.

In a CCD imager which has a light-receptive region divided into a plurality of areas to improve a data rate of output signals of the imager, the early-stage performance characteristics of the horizontal charge-transfer CCDs and the output amplifiers would adversely affect the image signals, so that ringing and defects would appear in the image signals output immediately after the beginning of a horizontal effective image period. Furthermore, the output signal of the imager has limitations in band imposed by a low-pass filter and an amplifier circuit in a later step performed in an image signal processing circuit, and thus an adequate signal level of the first picture element can not be obtained immediately after the beginning of the effective image period. Accordingly, when the image signals output from respective areas of the divided light-receptive region are combined to constitute one complete image, vertically striped noise, in picture elements located at the junctures between adjoining light-receptive areas, would make it difficult to produce a seamless image.

This invention has been made to provide an image pickup apparatus that can reduce noise that would be produced in picture elements located at the junctures between adjoining light-receptive areas, to obtain image signals adequate to produce a seamless image, and that can reduce the loss in image quality that would be caused by the effects of sample-and-hold pulses and other operations in subsequent processes performed in various circuits.

An image pickup apparatus as one exemplified aspect of this invention is shown in Fig. 1. The apparatus includes: (1) a solid-state imager that includes a plurality of light-receptive areas (number of areas is denoted by N) each having a plurality of picture elements and outputs image signals corresponding to the picture elements from the light-receptive areas; (2) a sample-and-hold circuit that detects at prescribed times instantaneous values of the image signals output from each of the light-receptive areas and continuously outputs each detected value of the image signals until subsequent detection of the image signals is made; and (3) a driving circuit that generates driving pulses and sample-and-hold pulses, wherein a horizontal charge-transfer circuit of each light-receptive area of the solid-state imager is driven with the driving pulses, and the sample-and-hold circuit is driven with the sample-and-hold pulses in synchronization with the driving pulses.

Figure 2 shows a timing chart of an exemplary operation of the image pickup apparatus. After the output of the image signals corresponding to the picture elements that are output first and last among those from each light-receptive area, the driving circuit stops driving the horizontal charge-transfer circuit and the sample-and-hold circuit for a specific period of time at least as long as required for horizontal charge-transfer of one picture element, and starts intermittently driving the horizontal charge-transfer circuit and the sample-and-hold circuit. Consequently, among the image signals corresponding to the picture elements that are output first and last among those from each light-receptive area, the sample-and-hold operation or analog-to-digital conversion to omit the rising period of the first image signal and the falling period of the last image signal makes the output levels of the first image signal and the last image signal accurate. As a result, when the output signals from the divided light-receptive areas of the imager are combined into one, noise that would be produced in picture elements located at the junctures between adjoining light-receptive areas can be reduced, and image signals adequate to produce a seamless image can be obtained.

Figure 2